

**A REPORT OF THE AAWG  
RECOMMENDATIONS FOR REGULATORY ACTION TO PREVENT  
WIDESPREAD FATIGUE DAMAGE IN THE COMMERCIAL AIRPLANE FLEET**

**1.0 EXECUTIVE SUMMARY**

In August 1997, the FAA and JAA issued a Tasking Statement through the Aviation Rulemaking Advisory Committee (ARAC). This Tasking Statement requesting that a non-advocate group be formed to examine whether or not rule-making should be initiated that would require audits of airplane structure to preclude the occurrence of widespread fatigue damage in the commercial airplane fleet. This report represents the work product of that Tasking Statement.

The Tasking was assigned to the Airworthiness Assurance Working Group (AAWG) in September 1997. This report is the culmination of 18 months of effort. In the process of the work, several conclusions and recommendations were reached. These results are presented below.

**1.1 CONCLUSIONS**

- With respect to the 1993 AAWG Report entitled Structural Fatigue Evaluation for Aging Airplanes
  - That the conclusions and recommendations of the 1993 AAWG Report are still generally applicable.
  - That AC 91-56A, released in April 1998 by the FAA has many inconsistencies in use of terminology and should be corrected.
  - That the list of structure susceptible to MSD/MED from the 1993 AAWG Report has been validated and expanded to include additional examples from industry experience.
  - That interaction of discrete source damage and MSD/MED need not be considered as assessment of total risk is within acceptable limits.
  - That because of the instances of MSD/MED in the fleet and the continued reliance on surveillance types of inspections to discover such damage, rules and advisory material should be developed that would provide specific programs to preclude WFD in the fleet.
- With respect to maintenance programs:
  - That an effective aging airplane program including a Mandatory Modification Program, Corrosion Prevention and Control Program, Repair Assessment Program, and a structural supplemental inspection program (SSID or ALI) is a necessary prerequisite for an effective program for MSD/MED.
  - That as long as there is an effective corrosion prevention and control program, interaction of MSD/MED with environmental degradation is minimized.

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- That the use of a Monitoring Period for the management of potential multiple site damage and multiple element damage (MSD/MED) scenarios in the fleet is possible if MSD/MED cracking is detectable before the structure loses its required residual strength.
- That any program established to correct MSD or MED in the fleet needs careful consideration for the necessary lead times to develop resources to implement fleet action.
- That there is no universally acceptable or required damage size used for certification compliance.
- With respect to research programs:
  - That additional research into the residual strength behavior of structure with MSD/MED should be conducted to supplement existing database.
  - That the highest potential to achieve the necessary improvements of flaw detectability is seen in the field of semi-automated eddy current systems.
- With respect to the Fleet Health and MSD:
  - That every pre-amendment 45 commercial jet type airplane has had instances of MSD/MED in either test or service.
  - That normal inspections (e.g. maintenance programs plus aging airplane programs) conducted by the airlines using procedures developed by the manufacturer have found numerous instances of MSD/MED in the fleet since 1988.
  - That the value of SDRs in determining the health of the fleet with respect to MSD/MED occurrence is limited.
- With respect to Analytical Assessment of MSD/MED:
  - Sufficient technology exists to complete the audit in a conservative manner.
  - That most OEMs have voluntary WFD audit programs in progress.
  - That damage scenarios involving combinations of MSD and MED must be considered if there is a possibility of interaction.
  - That the AAWG participating manufacturers have developed different but viable means of calculating the necessary parameters to characterize MSD/MED and define appropriate maintenance actions whether it be a monitoring period or structure modification/replacement.
  - That the analysis procedures used to characterize MSD/MED scenarios on airplanes needs careful correlation with test and service evidence.

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## **1.2 RECOMMENDATIONS**

The following recommendations are made as a result of this study:

- That the FAA review and make changes to AC 91-56A as delineated in section 4.2.1 and 4.2.2 of this report. These changes are intended to remove ambiguous use of terminology and provide additional guidance for entities performing the structural Audit
- That the FAA fund research detailed in Section 6.0, In addition:
  - Every effort should be made to make data from tests conducted in all research programs available at the earliest possible time before formal reports are issued.
  - Tests currently funded, involving lead crack link-up, should be accomplished as soon as possible to support the first round of audits due in three years.
- That the FAA issue a subsequent tasking to ARAC to develop necessary new and/or revised certification and operational rules with advisory material to make mandatory audit requirements for MSD/MED for all transport category airplanes. This recommendation includes the development of rules and advisory material as detailed in Section 10.0.
  - Existing Transport Category Airplanes - A FAA 121 (New) Rule and/or Part 39 (Amended)
  - New Certification Programs
    - FAA 25.1529 rule revision
    - FAA 121 (New) Rule for Operator Compliance
  - FAA AC for Both 121 (New) and 25.1529 (Revised) Rule
- That WFD audits for nearly all pre-amendment 45 commercial jet airplanes should be completed and OEM documents published by December 31, 2001, with some exceptions. On other commercial jet transports, audits should be completed before the high time airplane reaches their respective design service goals.
- That a SSIP or equivalent program and Repair Assessment Program for Post Amendment 45/Pre Amendment 54 airplane be developed and implemented.
- That any rule published as a result of the subsequent tasking become effective one year after final rule publication.
- That the analysis of STCs to primary structure be held to the same audit requirements (criteria and schedule) as OEM Structure.